

teaches an electroluminescent film device with a light-emitting layer where an excited state generated by electron hole recombination is utilized for photon generation, a light-emitting layer containing a material in which the quantum number of orbital angular momentum and the quantum number of excited state spin are convertible into each other by their interaction and wherein the material is a molecule in which a heavy metal atom is bonded to or coordinated to an organic material (Ir(ppy)_3); and a light-emitting molecule (DCM2), each as an independent dopant. The Examiner takes the position that the limitation in Claims 6, 11 and 12, wherein the light-emitting layer is an organic film formed by simultaneous vapor deposition, is a processing limitation and that it carries no weight in a claim drawn to a device.

Regarding Claims 4, 5, 9 and 10, the Examiner alleges that Forrest teaches that the light-emitting molecule (PtOEP) is a molecule in which a heavy metal atom (Pt) is bonded or coordinated to an organic material. The Examiner further alleges that Forrest teaches an intersystem crossing agent (ISC) comprised by benzil or other ISC agents and that ISC agents may be comprised by Ir(ppy)_3 or other metals of the third row of the periodic table coupled to organometallic compounds.

This rejection is respectfully traversed. Although it is well known in the art that an organic molecule wherein a heavy metal such as Ir is coordinated has function of spin conversion, the gist of the present invention resides not in the presence of the spin conversion material per se, but in the manner wherein the spin conversion material is contained in an organic LED element.

Forrest describes a material in which, on a base material composed of CBP , there are separately provided a layer to which a spin conversion material is added,

and another layer in which a light-emitting molecule is added, as shown in Fig. 1. In the present invention, on the other hand, a spin conversion material, a light-emitting molecule and a base material are simultaneously deposited, and molecules of these materials are present in a mixed state. Thus, the material in Forrest is clearly different from the material of the present invention in structure, and not just in the process in which the material is made.

As a further explanation of electroluminescence: on a base material, an electron and hole are combined to form an exciton, which moves to a light-emitting molecule to emit light. In a triplet excited state, an exciton moves to a light-emitting molecule via a spin conversion material to emit light. If an exciton is acquired by emission defect, etc., during the movement, it extinguishes without emitting light. The possibility of such acquisition becomes higher as the moving distance increases. In the present invention, the base material, spin conversion material and light-emitting molecule can be positioned within small area, such as not more than 1 nm or several molecules. In Forrest, the average distance between the spin conversion material and light-emitting molecule is approximately 10 to 100 times greater. Thus, the possibility of failure in light emission owing to extinguishment of the exciton is higher, and a considerable number of the excitons disperse in a direction opposite to the light-emitting layer, resulting in extinguishment without light emission. In the present invention, on the other hand, the three materials are mixed as described above so that efficiency of light emission is higher as compared with that of the structure of Forrest wherein the three materials are contained in the separate layers. (Incidentally, the light emission efficiency is further improved when a spin conversion material is used as a base material.) The structure of the present

invention and the advantages obtained thereby are neither disclosed nor suggested by Forrest.

Accordingly, it is respectfully submitted that Claims 1, 3 - 6 and 8 - 10 are not anticipated by, and would not have been obvious over, Forrest.

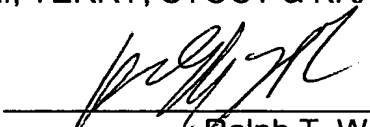
Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that Claims 1, 3 - 6 and 8 - 12 are in condition for allowance. Favorable reconsideration is respectfully requested.

Should the Examiner believe that anything further is necessary to place this application in condition for allowance, the Examiner is requested to contact applicants' undersigned attorney at the telephone number listed below.

Kindly charge any additional fees due, or credit overpayment of fees, to Deposit Account No. 01-2135 (500.40580X00).

Respectfully submitted,
ANTONELLI, TERRY, STOUT & KRAUS



Ralph T. Webb
Reg. No. 33,047

RTW/RTW
(703)312-6600